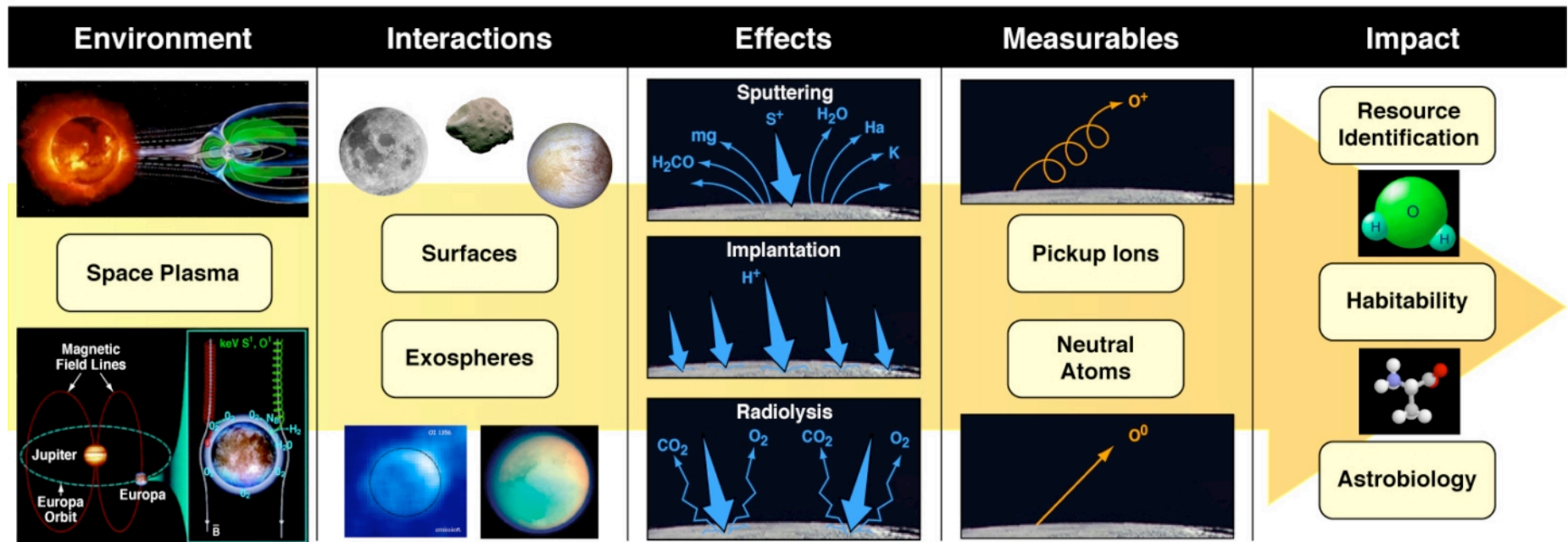


Toward a New Generation of Low Energy Neutral Atom Imagers

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John F. Cooper, Dennis Chornay, Paul Rozmarynowski and Michael Coplan**

Space Plasma-Solar System Body Interactions



•Most solar system bodies are unshielded by sizeable atmospheres (e.g. the Moon, asteroids and the Jovian satellites) and their surfaces are continually bombarded by the solar wind or magnetospheric radiation environment.

•In this interaction, secondary products are ejected including neutral atoms which reflect the composition of the body.

Europa - A Subsurface Ocean/Life?

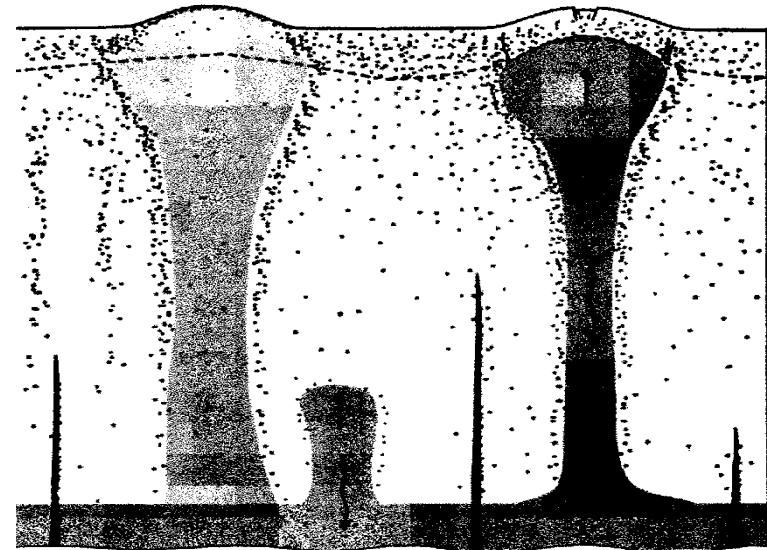
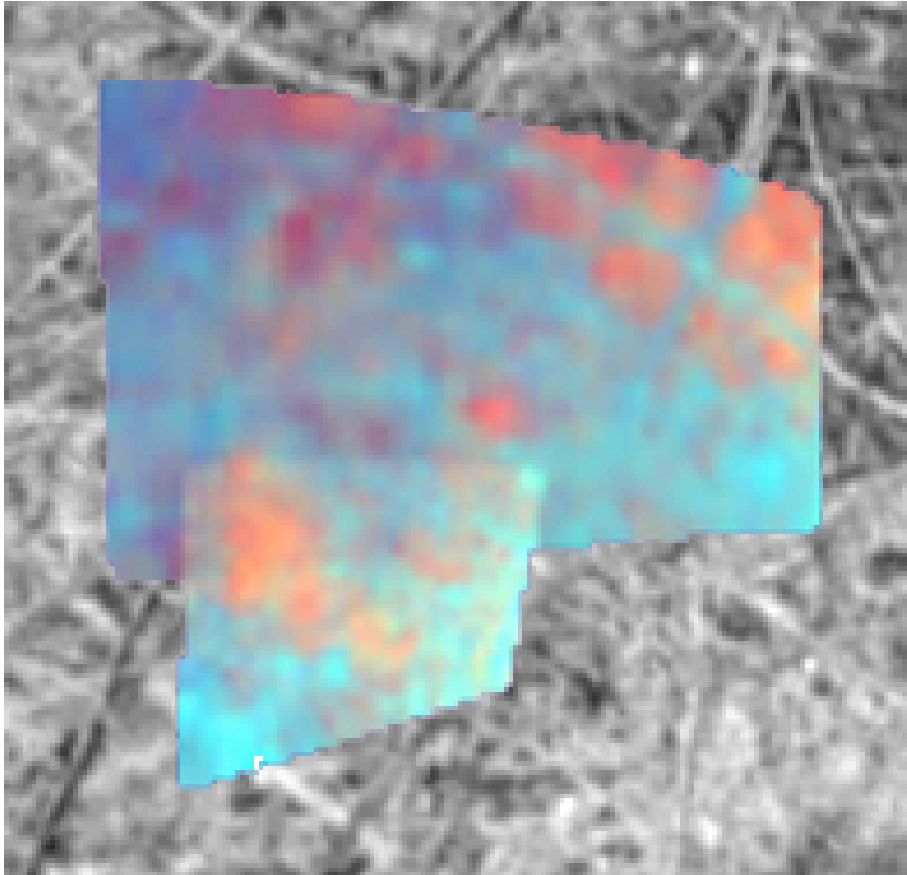
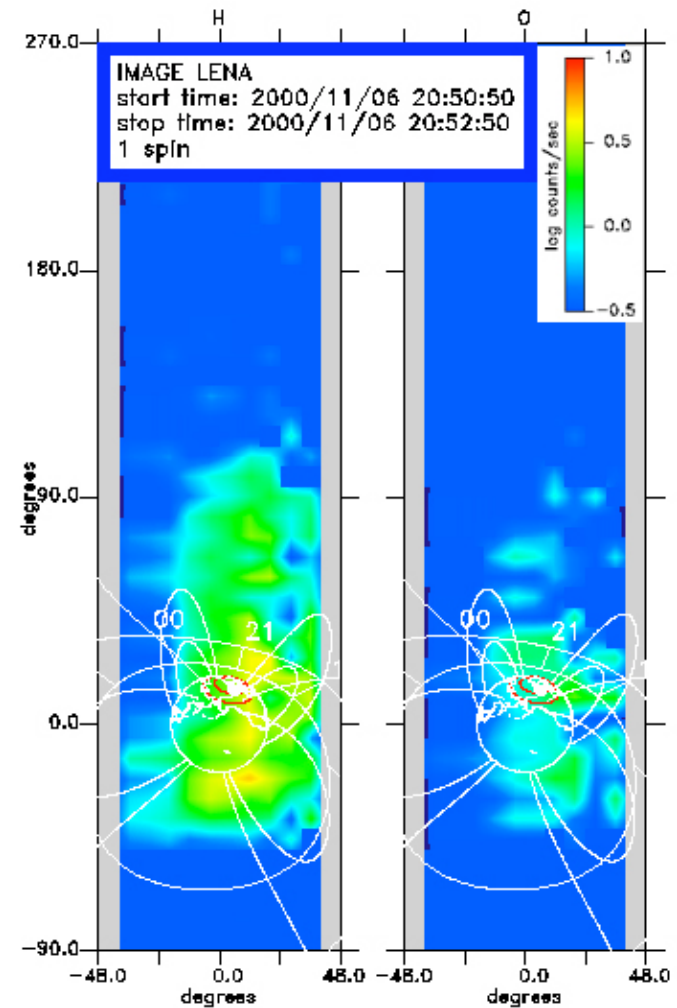
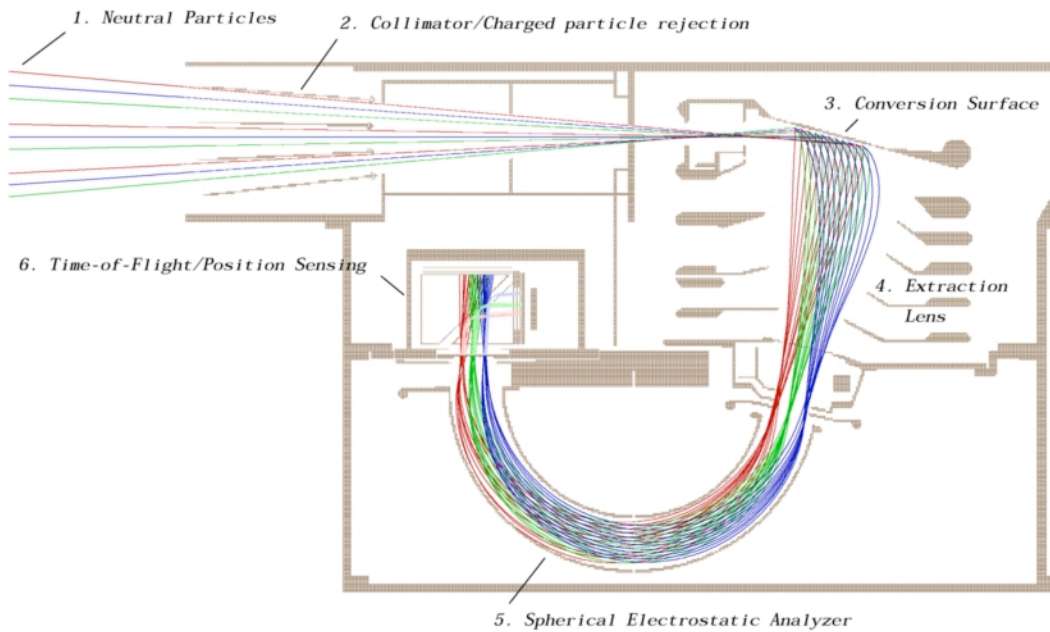


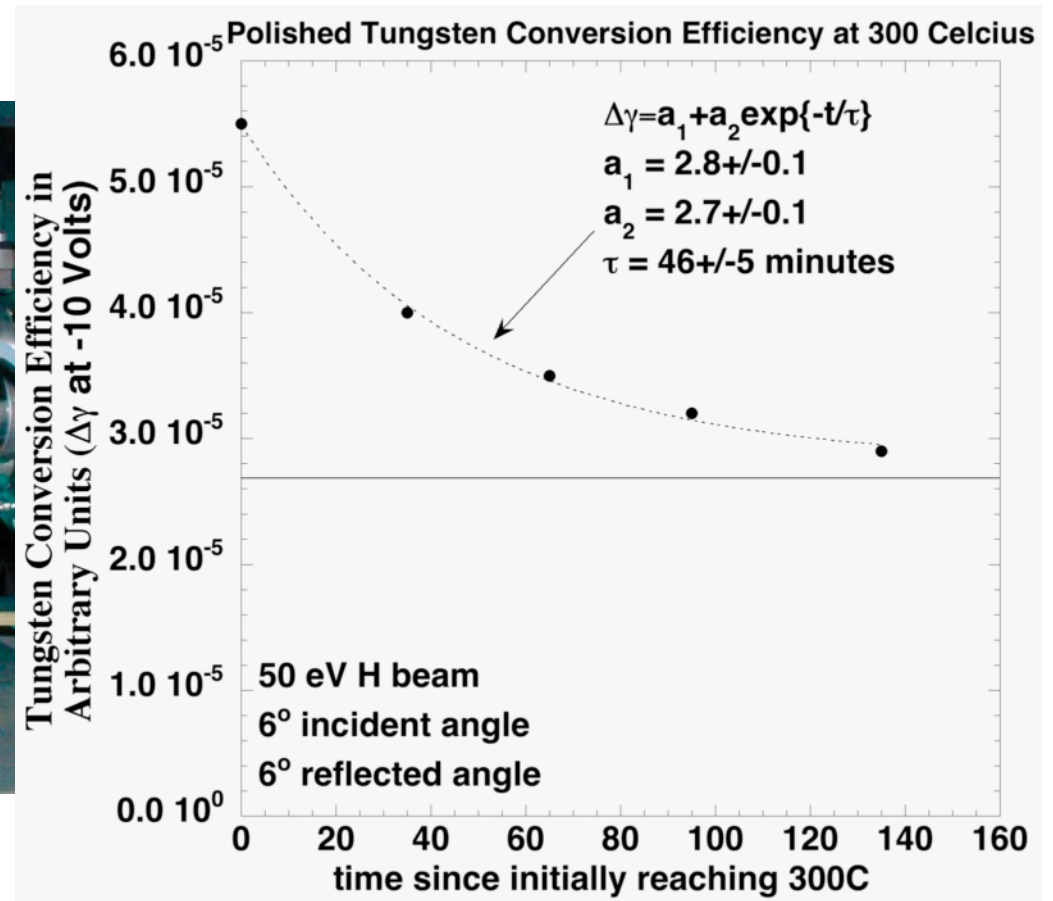
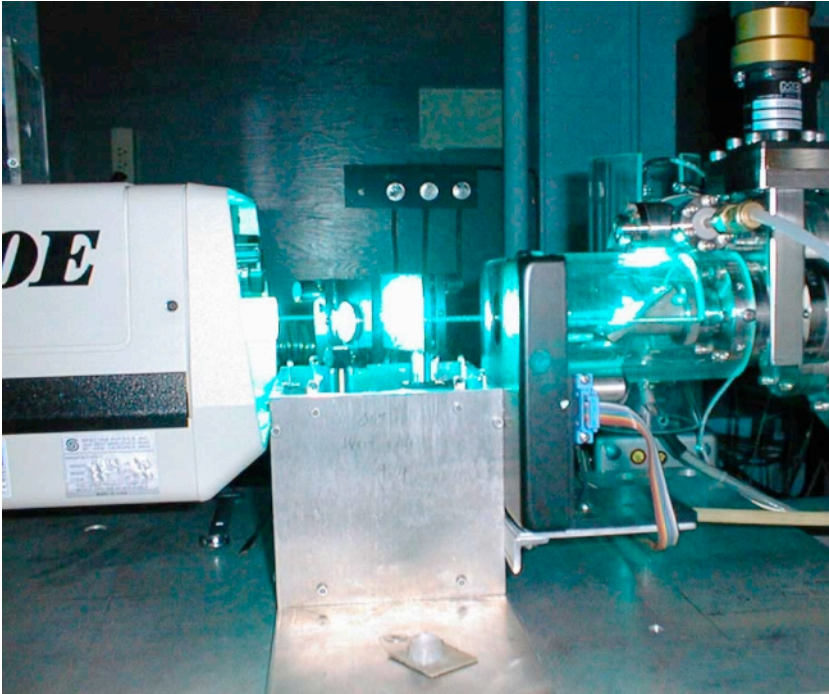
Fig. 2. Schematic illustration of thermally induced compositional diapirism. As warm ice (dark gray) rises from the base of the ice shell, it melts overlying low-eutectic contaminants (stipples) and brines drain downward (squiggled arrows). This allows compositional buoyancy to aid diapiric rise. Domes can be created by extrusion (left) or intrusion (right) of diapiric material. Low-eutectic contaminant concentration is least in the warmest ice and locally concentrated around the diapirs from which they are expelled. Dome topography and subsurface compositional gradients persist after plumes have cooled (left, lighter gray) until subsequent ice flow redistributes the constituents. Diking or other processes might replenish some oceanic contaminants, but it is likely that the ice shell will become depleted in contaminants.

- Europa may harbor a water ocean beneath its icy crust.
- If so, its convecting ice crust would likely bring evidence of life to the surface where it would be sputtered off by the Jovian radiation environment.

Current Neutral Atom Imaging Technology

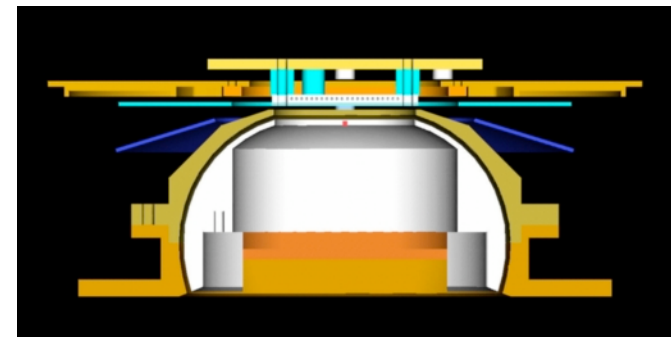
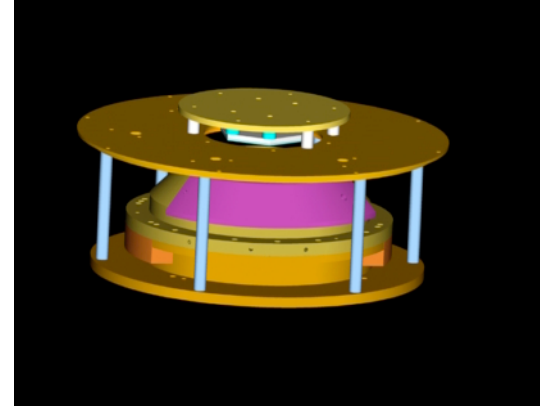
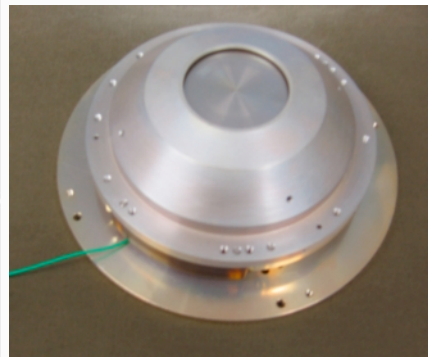
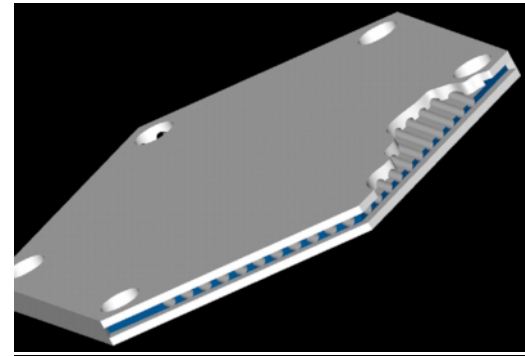
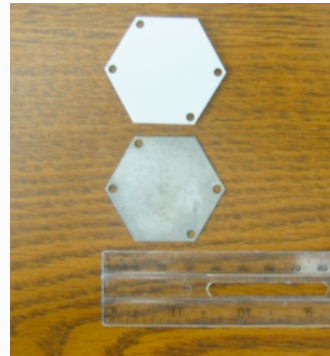
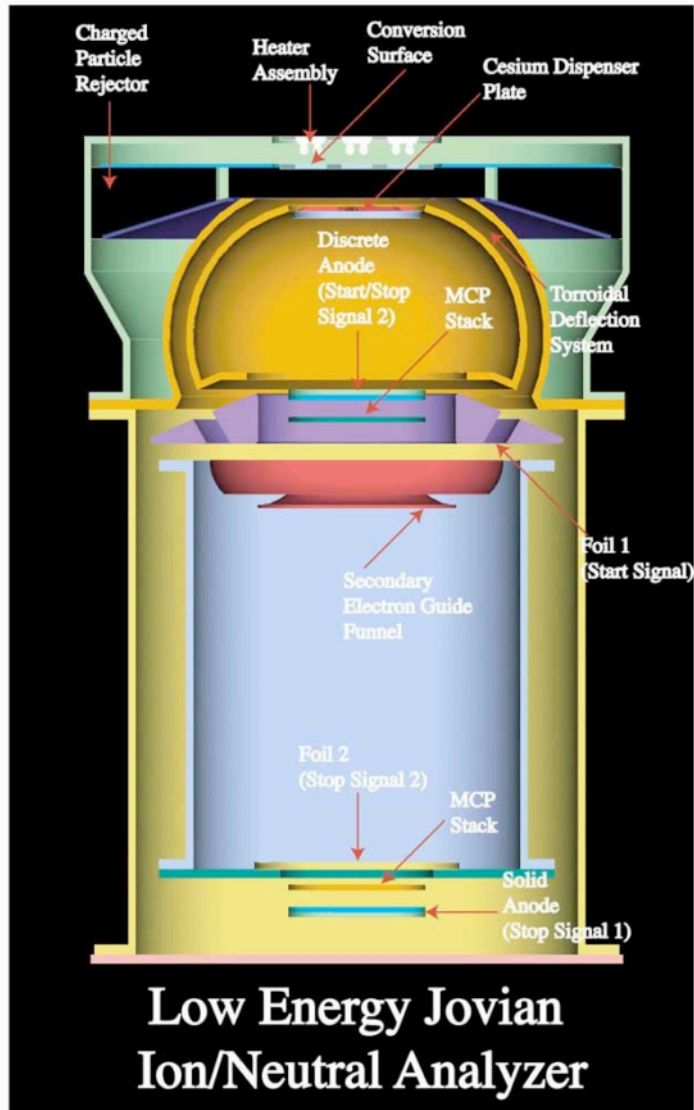


Effect of Adsorbates



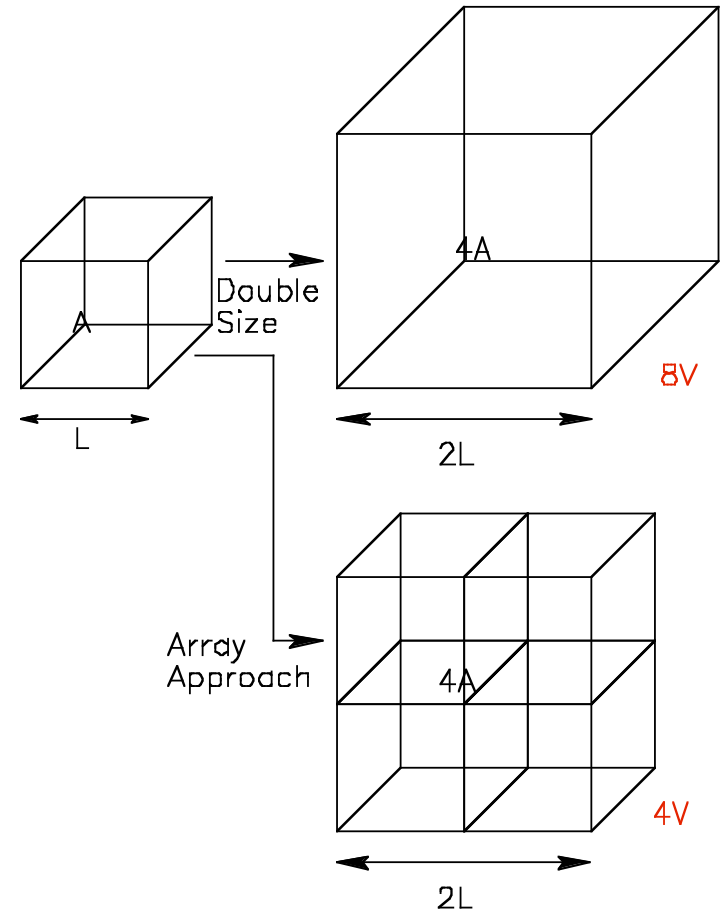
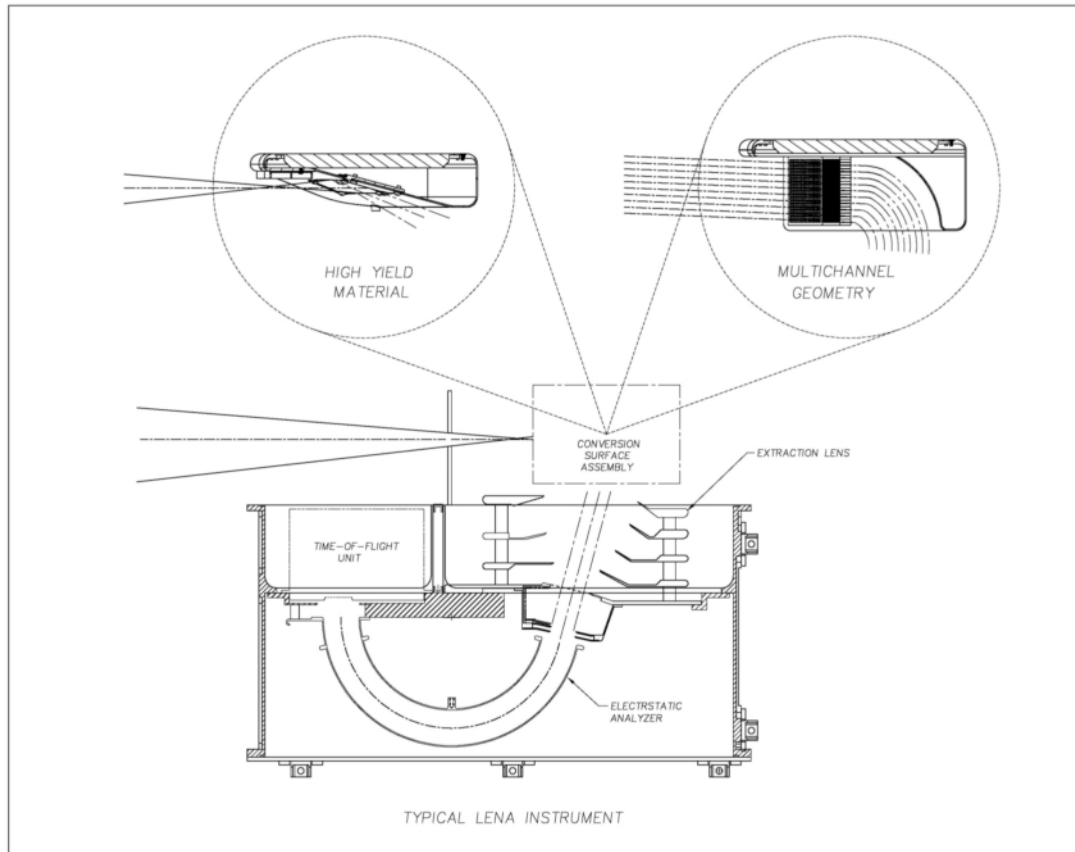
- Currently flown NAI instrumentation is limited to energies greater than about 15 eV.
- Adsorbates are responsible for most of the charge exchange occurring with metal surfaces.

Instrument Design



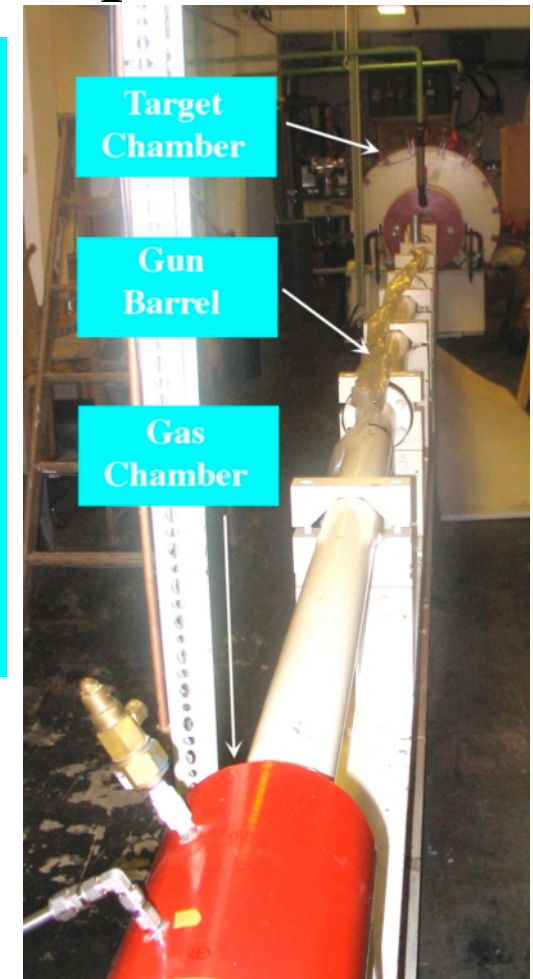
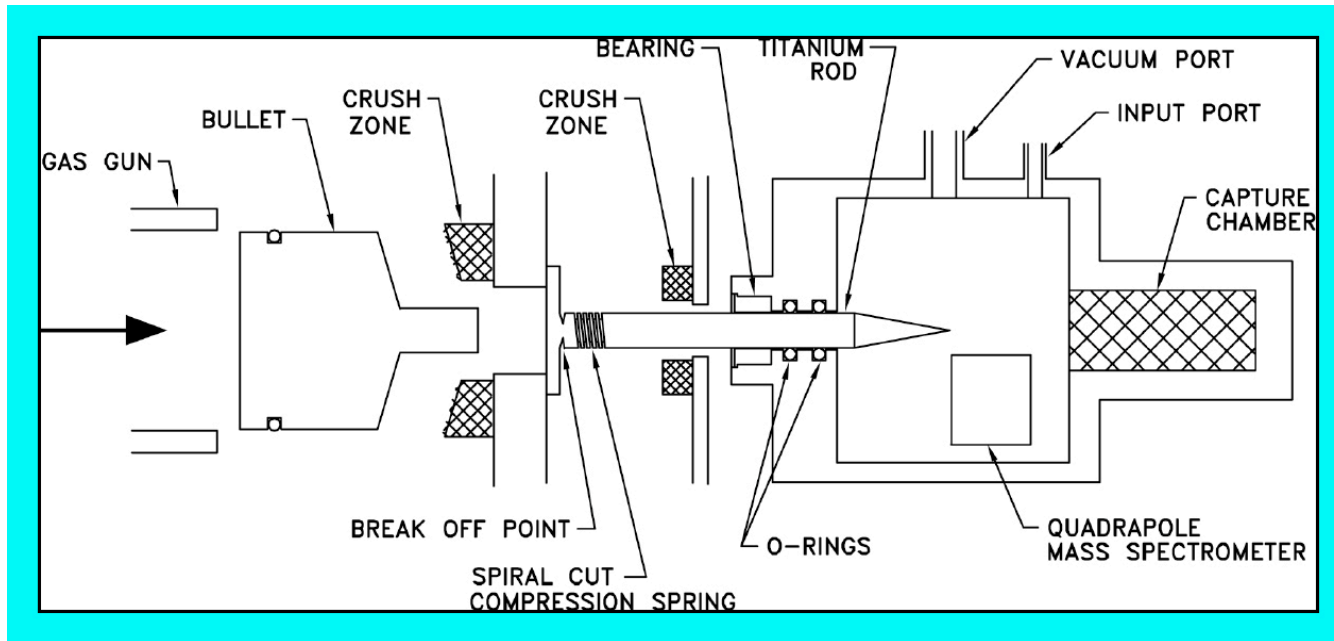
- Descoped instrument design very mature. Some parts fabricated.

Increasing Throughput



- **An array approach can increase effective area without dramatically increasing volume**

Ionization Via Hyper-Velocity Impacts



- There is no neutral beam facility designed to accelerate amino acids.
- Therefore, to test amino acid conversion, we move the surface through a gas at rest.

Conclusions

- **The Science Mission Directorate (SMD) is responsible for achieving several of NASA's strategic objectives.**
- **Among these responsibilities is exploring Jupiter's moons, asteroids and other bodies for evidence of life.**
- **This can be accomplished using extremely low energy (<10 eV) neutral atom imaging.**
- **This low energy neutral atom imaging is currently and will continue to be an important technique supporting NASA's Vision for Space Exploration.**

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Lunar Application

